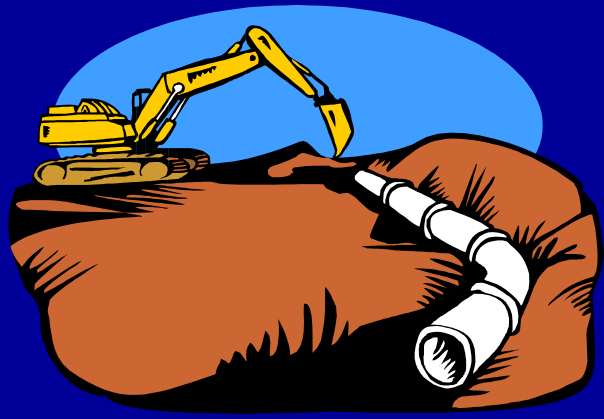
Excavations

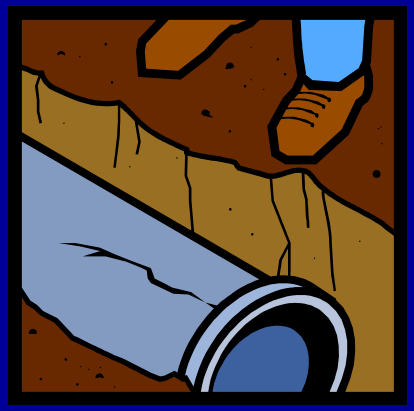
Excavation Hazards

Cave-ins are the greatest risk

Other hazards include:

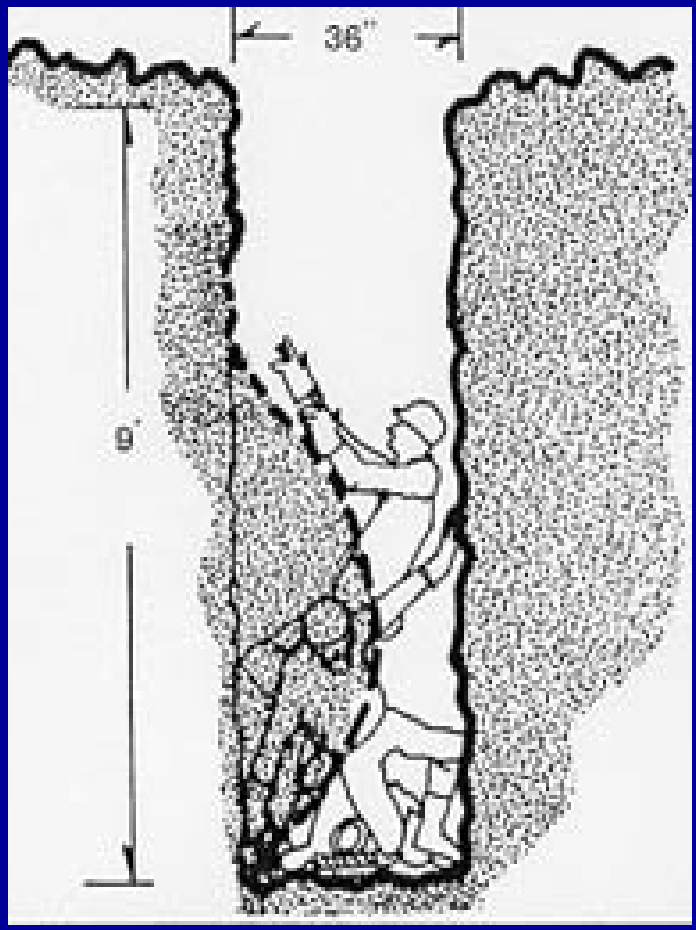
- **Asphyxiation due to lack of oxygen**
- **Inhalation of toxic materials**
- **Fire**
- **Moving machinery near the edge of the excavation can cause a collapse**
- **Accidental severing of underground utility lines**





Injury and Death

- **Excavating is one of the most hazardous construction operations**
- **Most accidents occur in trenches 5-15 feet deep**
- **There is usually no warning before a cave-in**



Definitions

- **Excavation** – a man-made cut, cavity, trench, or depression formed by earth removal.
- **Trench** – a narrow excavation. The depth is greater than the width, but not wider than 15 feet.
- **Shield** - a structure able to withstand a cave-in and protect employees
- **Shoring** - a structure that supports the sides of an excavation and protects against cave-ins
- **Sloping** - a technique that employs a specific angle of incline on the sides of the excavation. The angle varies based on assessment of impacting site factors.

Focus of Training

- The greatest risk at an excavation
- How to protect employees from cave-ins
- Factors that pose a hazard to employees working in excavations
- The role of a competent person at an excavation site

Protection of Employees

Employees should be protected from cave-ins by using an adequately designed protective system

Protective systems must be able to resist all expected loads to the system

Requirements for Protective Systems

A well-designed protective system

- **Correct design of sloping and benching systems**
- **Correct design of support systems, shield systems, and other protective systems**

Plus

Appropriate handling of materials and equipment

Plus

Attention to correct installation and removal

Equals Protection of Employees at

Design of Protective Systems

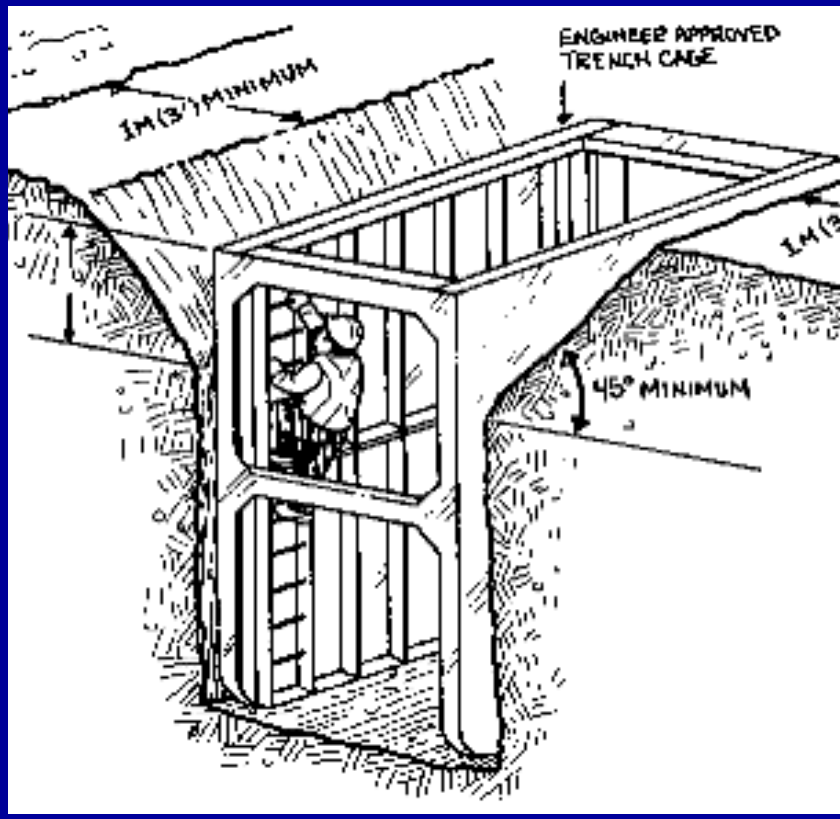
The employer shall select and construct :

- **slopes and configurations of sloping and benching systems**
- **support systems, shield systems, and other protective systems**

- **<u>Shield</u> - can be permanent or portable. Also known as trench box or trench shield.**
- **<u>Shoring</u> - such as metal hydraulic, mechanical or timber shoring system that supports the sides**
- **<u>Sloping</u> - form sides of an excavation that are inclined away from the excavation**

Protect Employees Exposed to Potential Cave-ins

- Slope or bench the sides of the excavation,
- Support the sides of the excavation, or
- Place a shield between the side of the excavation and the work area



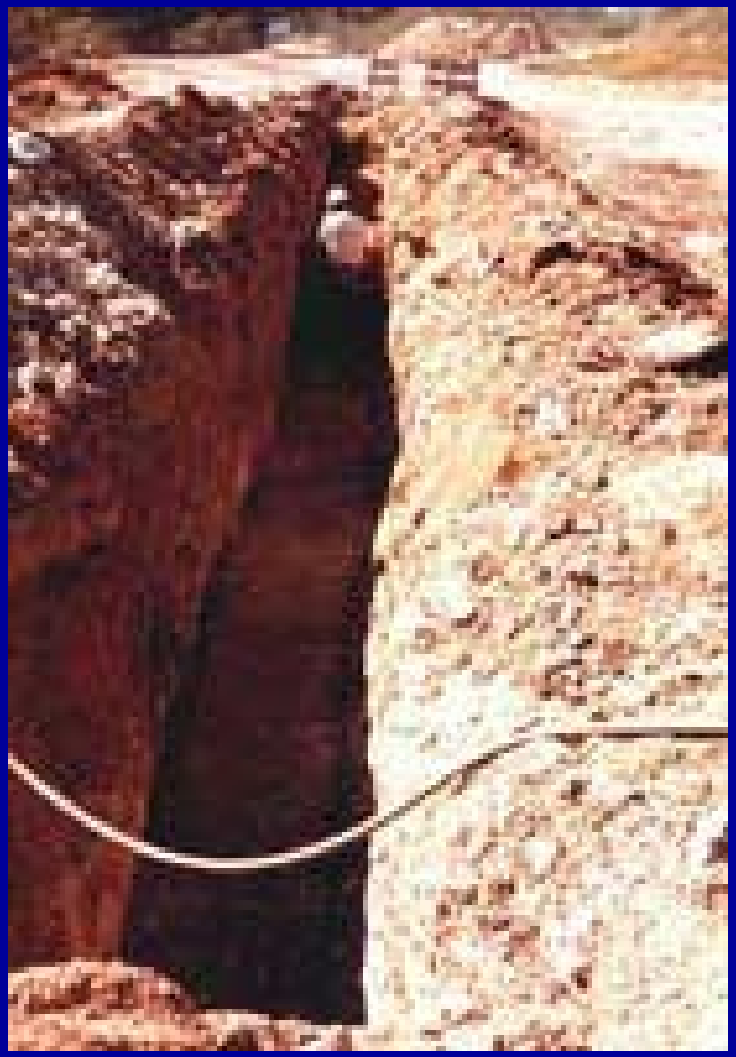
Cave-in Hazard

This excavation has inadequate support posts and egress access

Inadequate protective system

Inadequate Protective System

- This worker is in a trench with no protective system, that is not sloped or benched and has no means of egress



Factors Involved in Designing a Protective System

- Soil classification
- Depth of cut
- Water content of soil
- Changes due to weather and climate
- Other operations in the vicinity

Shoring

- General
  - Provides a framework to work in
  - Uses wales, cross braces and uprights
  - Supports excavation walls
- OSHA tables provide shoring data
  - Must know soil type
  - Must know depth and width of excavation
  - Must be familiar with the OSHA Tables

Trench Shield

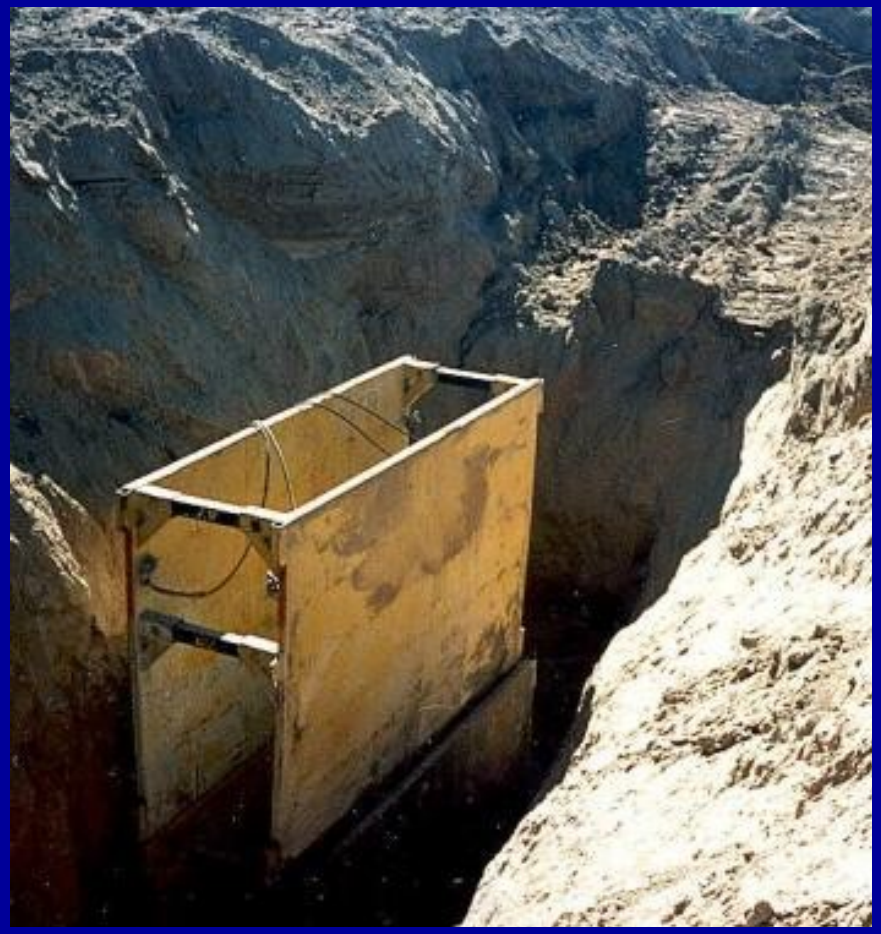
A trench shield was built around this work area

Hydraulic Trench Support

- Using hydraulic jacks the operator can easily drop the system into the hole
- Once in place, hydraulic pressure is increased to keep the forms in place
- Trench pins are installed in case of hydraulic failure

Materials and Equipment

- **Equipment used for protective systems must not have damage or defects that impair function.**
- **If equipment is damaged, the competent person must examine it to see if it is suitable for continued use.**
- **If not suitable, remove it from service until a professional engineer approves it for use.**



Protection from Vehicles

- Install barricades
- Hand/mechanical signals
- Stop logs
- Grade soil away from excavation
- Fence or barricade trenches left overnight

Hazardous Conditions

The weight and vibrations of the crane make this a very hazardous condition.

They should not be working under this crane.

Spoils

- Don’t place spoils within 2 feet from edge of excavation
- Measure from nearest part of the spoil to the excavation edge
- Place spoils so rainwater runs away from the excavation
- Place spoil well away from the excavation

Other Excavation Hazards

Water accumulation

Oxygen deficiency

Toxic fumes

Access/Egress

Falls

Mobile equipment

Water is Hazardous

When water is present in an excavation it is extremely hazardous to enter

Note that these workers are not wearing hardhats to protect them from materials falling into the trench

Water = Cave-in Hazard

These workers must be protected from cave-in. Note the water in the bottom of the trench. This is a very hazardous condition!

Hazardous Atmosphere

Test excavations more than 4 feet before an employee enters the excavation for:

- **Oxygen deficiency**
- **High combustible gas concentration**
- **High levels of other hazardous substances**

Means of Egress

A stairway, ladder, or ramp must be present in excavations that are 4 or more feet deep, and within 25 feet of the employees

The ladder should extend 3 feet above the excavation

Access and Egress

These two ladders which are lashed together are not an adequate means of egress

The ladder should extend 3 feet above the top of the excavation

Protection from Falls, Falling Loads, and Mobile Equipment

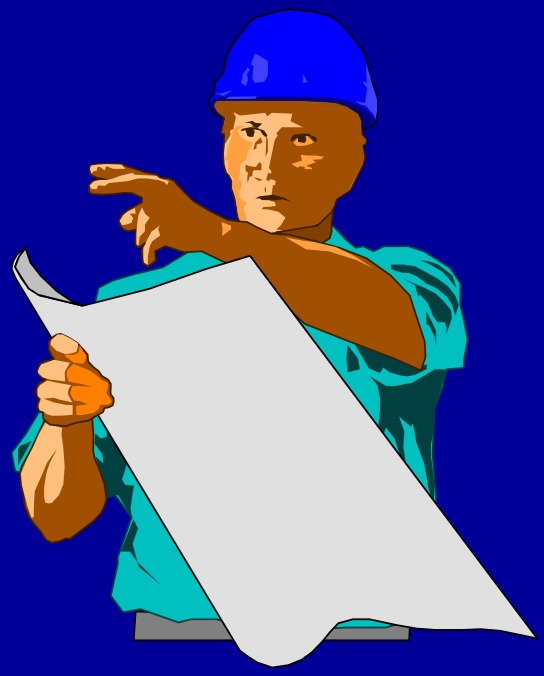
- Install barricades
- Use hand / mechanical signals
- Grade soil away from excavation
- Fence or barricade trenches left overnight
- Use a flagger when signs, signals and barricades are not enough protection

Competent Person

Must have had specific training in and be knowledgeable about:

- **Soils classification**
- **The use of protective systems**
- **The requirements of the standard**

Must be capable of identifying hazards, and authorized to immediately eliminate hazards



Inspections of Excavations

A competent person must make daily inspections of excavations, areas around them and protective systems:

- **Before work starts and as needed,**
- **After rainstorms, high winds or other occurrence which may increase hazards, and**
- **When you can reasonably anticipate an employee will be exposed to hazards.**

Inspections of Excavations

If the competent person finds evidence of a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions:

- **Exposed employees must be removed from the hazardous area**
- **Employees may not return until the necessary precautions have been taken**

Site Evaluation Planning

Before beginning excavation:

- **Evaluate soil conditions**
- **Construct protective systems**
- **Test for low oxygen, hazardous fumes and toxic gases**
- **Provide safe in and out access**
- **Contact utilities**
- **Determine the safety equipment needed**

Summary

- **The greatest risk in an excavation is a cave-in.**
- **Employees can be protected through sloping, shielding, and shoring the excavation.**
- **A competent person is responsible to inspect the excavation.**
- **Other excavation hazards include water accumulation, oxygen deficiency, toxic fumes, falls, and mobile equipment.**